

Naturally occurring materials were used as a source of energy before crude oil was extracted and used for fuel. As the oil economy developed over the years, the range of uses for crude oil diversified and we treated oil as an unlimited resource.

Our society is now dependent on oil products for a large number of materials used in our everyday lives, but we are coming to realise that crude oil resources are limited.

- Will we be able to replace all oil-based products when oil becomes scarce?
- If so, what will we use as raw materials?
- Will we return to using the naturally occurring materials that were used before crude oil?

Part 1

1. Coconuts are one example of a material that can be used to create biodiesel. What is biodiesel, and what other materials could be used?

2. What is the difference between a raw material that is renewable and one that is non-renewable? Give an example of each.

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3. Give three advantages for the use of biodiesel instead of fuel produced from crude oil.

4. Are there any disadvantages to using biodiesel instead of fuels produced from crude oil?

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5. The fact sheet, *Biodiesel dilemma*, refers to a life cycle value for carbon dioxide during production and use of biodiesel. What is your understanding of the term 'life cycle value'?

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6. At what point in the biodiesel life cycle is carbon dioxide from the atmosphere used?

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7. At what point in the biodiesel life cycle is carbon dioxide produced?

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8. It is sometimes said that the use of biodiesel does not add to the amount of carbon dioxide in the atmosphere. How could this be claimed? Is this claim reasonable?

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9. The carbon dioxide emission value from biodiesel compared with 'petroleum' diesel is -78%. What does this mean?

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10. In terms of carbon dioxide production, what is the main difference between the plant to plant-oil to biodiesel process and the crude oil to petroleum-diesel process? Which is more sustainable in terms of pollution produced over their lifecycles?

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Part 2: Biodiesel in Western Australia

The following data have been extracted from reports by the Australian Bureau of Statistics and the Department of Industry and Science.

- In 2013/14, there were 1 150 000 ha planted with canola in Western Australia¹.
- The average yield of canola seed from these plantings was 1.3 t ha⁻¹.
- Canola seed contains an average of 42% oil.
- An oil extraction press typically extracts 90% of oil in canola seed.
- Transesterification of one tonne of canola oil produces 700 L of biodiesel.
- Most canola grown in Western Australia is either exported to Asia for food, or exported to Europe for biodiesel.
- In 2013/14, Western Australia used 5600 ML of petroleum-derived diesel (including automotive, industrial & marine diesel)².

Use these data to answer the following questions.

11. Calculate the amount of biodiesel Western Australia could produce from the 2013/14 canola crop?

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12. What percentage of Western Australia's annual diesel usage could this supply?

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13. Is it feasible for Western Australia to use canola to produce enough biodiesel to supply the diesel needs for the state? Justify your answer.

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¹ Australian Bureau of Statistics. (2015). 7111.0-Principal Agricultural Commodities, Australia, Prelim., 2013-14.

² Office of the Chief Economist. (2014). Australian Petroleum Statistics. Department of Industry and Science.

Research question

14. The Biofuels Association of Australia was formed to represent all stakeholders in the biofuel industry in Australia. Based on information provided by their website at <http://biofuelsassociation.com.au>, what might be the future source of biodiesel in Australia?